

Splenic Injury During Percutaneous Nephrolithotomy

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ABSTRACT

Background: Injury to the spleen is a recognized complication during percutaneous renal access due to the close anatomical relationship of the spleen and the left kidney. However, transsplenic renal access is a rare complication of percutaneous nephrolithotomy and can also result in considerable morbidity, often requiring emergent splenectomy.

Methods: We present our experience with splenic injury during percutaneous nephrolithotomy managed conservatively with the use of a collagen-thrombin hemostatic sealant (D-Stat; Vascular Solutions, Inc., Minneapolis, MN) after delayed removal of the nephrostomy tubes.

Results: The patient had an uneventful recovery and was discharged home on postoperative day 6.

Conclusion: In select hemodynamically stable patients, nonoperative management with the adjunctive use of hemostatic sealants may be considered.

Key Words: Splenic injury, Percutaneous nephrolithotomy, Nonoperative management.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) has become the standard of care for large and complex renal calculi, demonstrating excellent stone clearance rates with acceptable morbidity in most patients.¹ Although some reviews note overall high complication rates with PCNL,² the majority of morbidity is related to percutaneous renal access and can be managed conservatively without significant sequelae. Major complications requiring intervention during PCNL occur in 0.9% to 4.7% of cases,¹⁻³ and include bleeding, sepsis, and injury to adjacent viscera. Injuries to the lung, pleura, liver, colon, duodenum, and spleen have been reported during percutaneous access to the kidney.^{4,5} Due to the close anatomic relationship of the left kidney and the spleen, iatrogenic splenic injuries are associated with renal surgery and percutaneous access; however, splenic injuries during PCNL are uncommon.⁶⁻⁹

The early diagnosis and treatment of splenic injuries can prevent associated morbidity and mortality, as missed splenic injuries are potentially fatal.¹⁰ Some authors advocate the management of splenic injuries during PCNL with emergent exploratory laparotomy and splenectomy.² We describe a case of iatrogenic splenic injury during PCNL, resulting from transsplenic renal access and tract dilation, managed conservatively with the use of a collagen-thrombin hemostatic sealant.

CASE REPORT

A 33-year-old woman was discovered to have a large left staghorn calculus on investigation of lower back pain with recurrent *Proteus* urinary tract infections. Her past medical history was otherwise notable for hypertension and morbid obesity. A noncontrast CT of her abdomen revealed a left staghorn calculus occupying the entire left renal pelvis and calices. The patient elected to undergo a percutaneous nephrolithotomy and was admitted one day prior to scheduled surgery to receive intravenous antibiotics.

Interventional radiology initially obtained renal access through 3 nephrostomy tracts using fluoroscopic guidance. The lower, middle, and upper pole calices were accessed by using a 21-gauge needle, and 6-French pyeloureteral catheters were advanced to the distal ureter

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over glide wires. The patient then underwent PCNL, and all 3 nephrostomy tracts were sequentially enlarged by using a 30-French by 15-cm balloon dilating catheter (Nephromax, Boston Scientific Corporation, Boston, MA). The most inferior nephrostomy tract was dilated first, followed by the mid and upper pole tracts. Bleeding occurred after dilating the upper nephrostomy tract, which was placed at the tenth posterior intercostal space. After the majority of the patient's stone burden was removed, three 22-French nephrostomy catheters and a double J ureteral stent were placed under fluoroscopic guidance. The estimated blood loss from the procedure was 750 mL. During the first 2 postoperative days, the patient had continued hematuria and was anemic with a hemoglobin of 6.0 g/dL. She was transfused a total of 6 units of packed red blood cells and otherwise remained hemodynamically stable. A noncontrast CT scan to assess any remaining stone burden revealed that the 2 upper nephrostomy tubes traversed through the spleen (**Figure 1A**). Following consultation with the general surgery service, the patient underwent continued observation as she remained hemodynamically stable and did not require any further blood products. The patient continued on bed rest in a monitored unit, with all 3 nephrostomy tubes in situ, and her urine gradually cleared. The 3 nephrostomy tubes were removed by interventional radiology on postoperative day 4, at which time a collagen-thrombin hemostatic sealant, D-Stat (Vascular Solutions, Inc., Minneapolis, MN), was injected into the 2 upper nephrostomy tracts. A repeat CT shortly after removal of the nephrostomy tubes confirmed that no active bleeding or hematoma was present. The patient otherwise made an uneventful recovery and was discharged home on postoperative day 6. She returned one month later for management of her residual stone disease within the left kidney and underwent ureteroscopy and laser lithotripsy. Delayed imaging at 6 months revealed successful stone clearance without perisplenic fluid collections (**Figure 1B**).

DISCUSSION

PCNL remains the treatment of choice for staghorn and complex renal calculi and is generally well tolerated with minimal morbidity.¹¹ Although vascular complications are reported with PCNL, injury to the spleen is rare. Due to the close anatomical relationship of the spleen to the left kidney, the risk of injury to the spleen during upper pole renal access is increased.

While splenic injuries may present acutely with hemodynamic instability, clinical signs and symptoms vary widely.

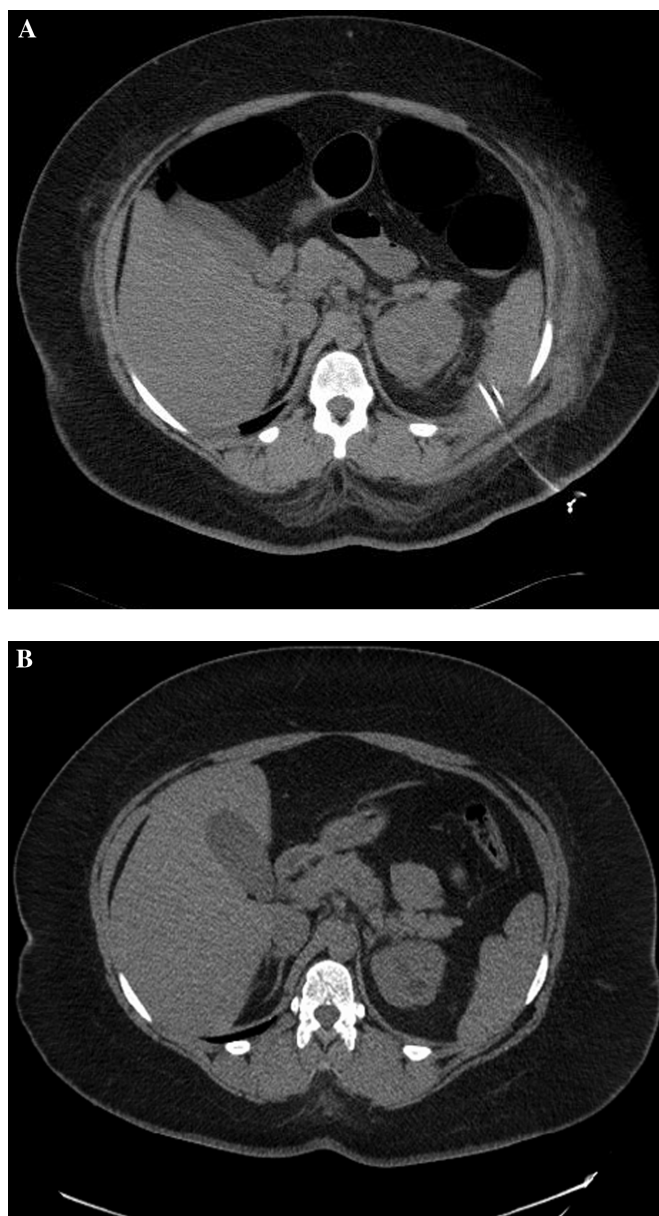


Figure 1. (A) Axial computed tomographic images after percutaneous nephrolithotomy to assess remaining stone burden, which demonstrated transsplenic renal access with a nephrostomy catheter after percutaneous nephrolithotomy and (B) at 6-month follow-up demonstrating resolution of injury without significant sequelae.

A heightened suspicion for vascular injuries or splenic trauma in the perioperative period should be considered in patients undergoing PCNL with excessive blood loss, hemodynamic instability, or severe abdominal pain. In our patient, splenic injury resulted from initial percutane-

ous access and was exacerbated after dilation of the nephrostomy tract to 30 French. Occult splenic injuries may be underreported and unrecognized, as CT imaging is not routinely used postoperatively. We recommend CT imaging in patients with excessive perioperative bleeding, because CT has a high specificity and sensitivity to facilitate identification of splenic trauma or injury to surrounding structures.¹² However, prevention is the best management of these complications. A careful review of preoperative imaging could identify anatomical variants, such as splenomegaly or a retrorenal colon or spleen.¹³ In these complicated cases, the use of additional imaging modalities such as ultrasound or CT guidance during initial percutaneous renal access should be considered instead of fluoroscopy to avoid potential injury to surrounding organs.

Historically, the nonoperative management of splenic injuries was associated with a high mortality rate. However, advances in imaging and new grading systems of splenic injuries have allowed select patients to be successfully managed conservatively, thus avoiding laparotomy and splenectomy.¹⁴ Although the incidence of splenic injury with percutaneous renal access is more common,⁶ splenic injuries during PCNL are rare and have potential for sig-

nificant bleeding due to a larger dilation of the nephrostomy tract. The morbidity of such an injury would depend on the number of attempts used to gain renal access as well as the diameter and location of the nephrostomy tract within the spleen. We reviewed reported cases of splenic injury during PCNL and noted that a significant number of cases were managed operatively (**Table 1**). Some authors have recommended management with emergent laparotomy and splenectomy for splenic injuries²; however, a nonoperative approach may be pursued in select hemodynamically stable patients. These patients can be managed with bed rest, close monitoring, and the placement of large bore catheters to tamponade bleeding within the nephrostomy tracts. Most importantly, early recognition of such splenic injuries is vital to ensure adequate patient resuscitation and to prepare for possible emergent splenectomy if conservative management fails. In the present case, the patient was closely observed after delayed removal of the nephrostomy tubes with injection of a collagen-thrombin hemostatic sealant (D-Stat; Vascular Solutions, Inc., Minneapolis, MN) into the nephrostomy tracts. These hemostatic agents have also been successfully utilized as adjuncts to reduce bleeding from splenic injuries during renal surgery,^{15,16} and have been shown to be safe

Table 1.
Literature Review of Splenic Injuries During Percutaneous Nephrolithotomy

Author	(n=)	Management	Outcome*
Kondás et al ⁷	1	Exploratory laparotomy/splenectomy	Transfused 3 units PRBCs. Uneventful recovery
Carey et al ⁸	1	Bed rest, delayed nephrostomy catheter removal after 2 weeks	Uneventful recovery
Shah et al ⁶	2	1. Exploratory laparotomy/splenectomy	1. Transfused 4 units PRBCs. Uneventful recovery
		2. Exploratory laparotomy and hemostasis with fibrin glue	2. EBL 2000 mL Transfused 3 units PRBCs. Uneventful recovery
Schaeffer et al ⁹	3	1. Direct pressure over nephrostomy tract followed by serial monitoring for 3 days	1. Perisplenic hematoma without further active bleeding.
		2. Discharge home with delayed nephrostomy tube removal on postoperative day 15	2. Uneventful recovery
		3. Delayed nephrostomy tube removal on postoperative day 12	3. Uneventful recovery
Current study	1	Bed rest, delayed nephrostomy catheter removal after 4 days with injection of a collagen-thrombin hemostatic sealant into the nephrostomy tracts	EBL 750 mL. Transfused 6 units PRBCs. Uneventful recovery

*PRBCs, packed red blood cells; EBL, estimated blood loss.

and effective in controlling bleeding after the removal of nephrostomy catheters for 'tubeless' PCNL.^{17,18} Alternatively, splenic artery angioembolization may be used as a nonoperative management of splenic bleeding in select cases.¹⁹ Repeat CT imaging can be performed to detect early signs of active bleeding; however, emergent splenectomy is warranted if conservative management fails or for patients with evidence of hemodynamic instability.

CONCLUSION

The early recognition and management of splenic injuries during PCNL is paramount to prevent potential morbidity and mortality. Although patients may require emergent laparotomy with splenectomy, hemodynamically stable patients may be managed conservatively with close monitoring, delayed removal of the nephrostomy catheters, and with the adjunctive use of hemostatic sealants. Careful patient selection is essential to determine suitable candidates for this nonoperative paradigm.

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